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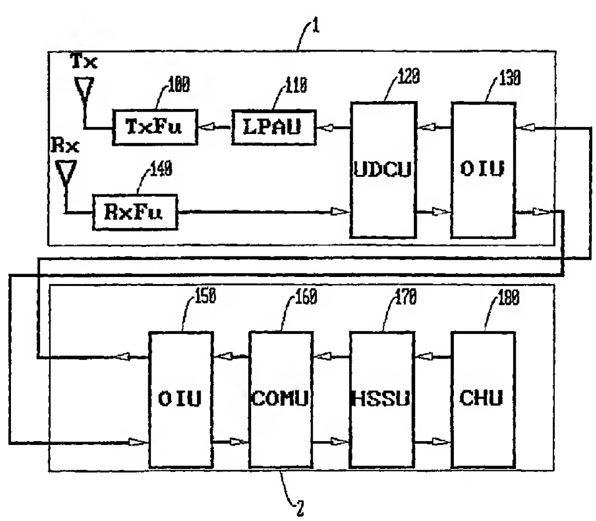
(54) Title: WIRELESS COMMUNICATION SYSTEM WHICH DYNAMICALLY ALLOCATES CHANNELS AND CHANNEL CARD UNIT FOR THE SYSTEM



(57) Abstract: This invention relates to a wireless communication system including a transceiver base station (BTS) and a base station controller (BSC) incorporating a channel card unit (CHU) for a cellular system, a personal communication system (PCS) and an international mobile telecommunication 2000 (IMT-2000) system and a channel card unit using in the wireless communication system. A conventional wireless communication system, since the CHU is incorporated in the BTS, is a cause for a big size of the BTS, and necessitates larger installation sites and higher costs for installation. In a wireless communication system dynamically allocatting channels, since the CHU is incorporated in the BSC instead of the BTS, a compact BTS can be achived. Therefore, problems relating to the securing of large installation sites and a high cost for installation can be solved and channel consumption can be reduced.

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Wireless Communication System Which Dynamically Allocates Channels and Channel Card Unit for the System

Technical Field

This invention relates to a wireless communication system including a base transceiver station(hereinafter, called 'BTS', the term refers to BTS of Cellular/PCS and Node B of IMT-2000) and a base station controller (hereinafter, called 'BSC', the term refers to BSC of Cellular/PCS and RNC of IMT-2000) for a cellular system, a personal communication system (PCS) and an international mobile telecommunication 2000 (IMT-2000) system and a channel card unit in the wireless communication system, and more particularly, to a wireless communication system with a channel card unit incorporated in BSC and to the channel card unit used.

Background Art

With reference to FIG. 1, a conventional BTS includes a channel card unit and a radio frequency (RF) unit. The channel card unit includes an RF up/down convertor and the RF unit includes an 20 RF up/down convertor. Since the channel card unit and the RF unit should be incorporated and interactive within the BTS, a subscriber should be allocated with

a channel in the BTS to log on to service network. Therefore, a conventional wireless communication system including BTS and BSC has the following problems:

i) the number of subscribers is limited by the BTS' channel capacity.

ii) the capacity to accomodate subscribers significantly reduces when the BTS channels fail.

iii) to accomodate more subscribers, the BTS has to have more channel card units, which results in a bigger BTS, a larger installation site and a higher cost of installation and maintenance.

iv) a failure of a RF path causes a simulated failure of the channel card unit that is integrated with the faulty RF path.

Disclosure of the Invention

This invention is contrived to solve the above-mentioned problems.

The first object of this invention is to provide a dynamic channel allocation system and channel card units used in the system which can accommodate as many subscribers as possible with a small number of channels.

The second object of this invention is to provide a dynamic channel allocation system and channel card units used in the system for preventing the failure of BTS channels from impacting

the subscriber capacity.

It is the third object of this invention to provide a dynamic channel allocation system and channel card units used in the system by placing channel card units with a BSC, thus implementing a compact BTS and addressing problems related to the physical space of installation sites and the high cost of installation and maintenance.

Detailed Description of the Invention

This invention relates to a wireless communication system accommodating as many subscribers as possible with a small number of channels by designing a large-scale channel bank utilizing the fact that the Erlang B Table which is applicable to the design of the channel capacity is proportional to the number of channels available to subscribers.

To achieve the above objects, this invention uses the following technologies:

i) an optical transmission technology between a base-band signal unit and a radio frequency (RF) signal processor,

ii) a high-speed router technology to route digital signals generated at high speeds to relevant channels,

iii) a signal-combining technology applicable to a channel that offers a signaling interface to a relevant BTS in order

to transmit the received signal to the BTS,

iv) a local switch technology for processing base-band signals through interface with the high-speed switch unit.

The wireless communication system for dynamically allocatting cannels of the this invention consists of a BTS unit and a BSC unit.

The BTS unit includes an receiving(Rx) unit for limiting the band of RF signals transmitted by a MS and received by an Rx antenna, and amplifying the received weak signals in a reverse link, an up/down converter for down-converting the RF signals received from the Rx unit into base-band signals in the reverse link and up-converting the base-band signals into the RF signals in a forward link, the 1st optic interface unit for modulating the base-band signals to optic signals in the reverse link and modulating the optic signals to the base-band signals for transfer to the up/down converter in the forward link, a multi-channel amplifier for receiving and amplifying multi-channel RF signals received from the up/down converter simultaneously in the forward link, a transmitting(Tx) unit that limits the RF signals received from the multi-channel amplifier within a specific bandwidth and radiating them.

The BSC unit includes the 2nd optic interface unit for modulating the optic signals from the BTS unit into the base-band

signals in the reverse link and modulating the base-band signals into the optic signals in the forward link, a high speed switch unit (HSSU), a combiner unit (COMU) for distributing the base-band signals transmitted by the 2nd interface unit to the HSSU in the reverse link and combining the signals received from the HSSU digitally in the forward link, a channel card unit (CHU) that digitalizes the signals received from the HSSU and returns the digitalized signals to the HSSU. And, the combiner unit (COMU) which includes a combiner, a processor and the interface unit of the high speed switch unit((HSSU).

The channel card unit (CHU) comprises a local switch for interfacing with the high speed switch unit and routing signals received from the high speed switch unit to relevant channels in parallel at high speeds, a BSC modem for interfacing signals serially, and more than one channel block for including a serial-to-parallel unit that converts serial signals into parallel signals and vice versa in order to interface with the local switch and the modem and that is subject to the interface of the modem.

Brief Description of the Drawings

The above objects. and advantages of this invention will become more apparent by describing in detail the preferred mbodiments thereof with reference to the attached drawings in

which:

FIG. 1 is a block diagram showing the architecture of a conventional BTS ;

FIG. 2 is a brief block diagram of a wireless communication system according to this invention; and

FIG. 3 is a detailed block diagram of the wireless communication system according to this invention.

Best Mode for Carring out the Invention

This invention will be described below in detail with reference to the accompanying drawings.

FIG. 2 is a brief block diagram of the system according to this invention, which includes a BTS and a BSC. As shown in FIG. 2, the wireless communication system of this invention includes the BTS (1) and the BSC (2). The BTS (1) includes an Rx Front-End Unit (RxFU, 140), a Tx Front-End Unit (TxFU, 100), an UP/DOWN Converter (UDCU, 120), a Linear-Power Amplifier Unit (LPAU, 110) and an Optic Interface Unit (OIU, 130). The BSC (2) includes an Optic Interface Unit (OIU, 150), a Combiner Unit (COMU, 160), a High Speed Switch Unit (HSSU, 170) and a Channel Card Unit (CHU, 180). As for configuration of the BTS (1), the RxFU(140) is positioned on the front end of the RFU in the reverse link, and includes a Band Pass Filter (BPF) and a Low Noise Amplifier (LNA)(not shown). The BPF limits the band of

the RF signals transmitted by MS and received by the Rx antenna. The LNA (not shown in the figure) amplifies the received weak signals. There are two separate paths (antenna diversity) for two antennas per sector, and those paths are separate blocks.

TxFU (100) limits the RF signals radiated over the air within the specified bandwidth using the BFP and transmits them to the Tx antenna.

A total of 9 BPFs are used when the system supports 3 sectors (3 BPFs per sector: 1 BPF for TX, 2 BPFs for RX). The BPFs included in the RxFU filter the signals received from the Rx antenna and transfer them to the LNA. The BPFs included in the TxFU filter the signals from the linear high-power amplifier and transmit them to the Tx antenna. The LNA is a high-frequency, low-noise amplifier that amplifies the RF signals incoming through the band-pass filter on the Rx antenna and sends them into the DNCA.

The UDCU (120) down-converts the RF signals received from the RxFU (140) into base-band signals in the reverse link. In the forward link, the UDCU up-converts the base-band signals into the RF signals. The UDCU includes the DNCA, the UPCA and the RFCA. The DNCA down-converts the RF signals received from the MS into base-band signals and transmits the base-band signals to the CHU (180). Then, the DNCA attenuates the level of the signals under the control of the RFCA for dynamic cell control.

The UPCA up-converts the base-band signals into the RF signals and transmits the RF signals to the LPAU (110). Then, the UPCA attenuates the level of the signals under the control of the RFCA for dynamic cell control.

The RFCA manages, controls and monitors all the modules included in the RFU.

The OIU (130) performs optical transmission interface between the BTS and the BSC by modulating the base-band signals into optical signals or vice-versa.

The LPAU (110) receives the RF signals provided by the multiple UDCUs as one input, and amplifies them simultaneously.

The LPAU is a multi-channel amplifier that prevents the signal distortion caused by the non-linearity of the amplifier, and inter-modulation distortion generated when multiple signals are inputted simultaneously.

With reference to FIG. 3, the configuration of the BSC according to this invention will be described in detail.

The OIU (150) offers optical transmission interface between the BTS and the BSC by modulating base-band signals into optical signals and vice-versa.

The COMU (160) distributes the base-band signals. In the reverse link, the COMU provides the base-band signals modulated by the UDCU to the CHU. In the forward link, the COMU

combines the signals and provides them to the LPA. The COMU includes a combiner (161) and a processor & the HSSU interface unit(162). The combiner (161) combines the signals received from a channel block digitally and transmits them to the LPAU. As the signals are combined, amplified and filtered before being transmitted to subscribers who share the same frequency over the air, the combiner is used to interface to the LPAU and the TxFU that performs amplification and filtering respectively. The processor & the HSSU interface unit(162) processes the physical layer and the protocol for interface with the HSSU (170). When interfacing with the HSSU (170), the processor & HSSU interface unit(162) not only assigns destination addresses, but also performs all controls of the COMU (160), software downloading and status management.

The HSSP (170) is an asynchronous transmission mode (ATM) switch which can switch data at high speeds exceeding giga bit per second.

The CHU (180) includes multiple channel blocks. Each channel block includes a local switch (181), a serial-to-parallel unit (182) and a BSC modem (183). The local switch (181) interfaces with the HSSU (170) and switches base-band signals. The local switch (181) routes the signals received from the HSSU (170) to relevant channels in parallel. The BSC modem (183) modulates and demodulates the CDMA signals in order to

communicate with the MS and performs the signal interface serially. The serial-to-parallel unit (182) converts serial signals to parallel signals or vice versa in order to implement the interface between the local switch (181) and the BSC modem (183).

With reference to FIGS. 2 and 3, interactions between the above components will be described from the perspective of the signal flow from the BTS to the BSC, and from the BSC to the BTS. First, in case of the signal flows from the BTS to the BSC, after the BTS receives signals transmitted by the MS, the signals are filtered by the frequency band filter that intends to communicate with the BTS. Then, the filtered signals are down-converted into base-band signals by the UDCU (20), converted into optical signals by the OIU (130) and transmitted to the BSC. The optical signals received by the BSC are modulated into base band signals by the OIU (150) and transmitted to the COMU (160), the HSSU (170) and the CHU (160). The signals transmitted to the CHU (160) are converted into parallel signals by the local switch in the CHU (160), and converted into serial signals by the serial-to-parallel unit (182) and transmitted to the BSC modem (183). Second, in case of the signal flows from the BSC to the BTS, signals generated by the BSC modem (183) are transmitted to the HSSU (170) through the serial-to-parallel unit (182) and the local switch (181). Then, the signals are combined by the combiner (161) in the COMU (160), converted into optical signals

by the 2nd optical interface unit (150) and transmitted to the BTS.

The optical signals received by the BTS are converted into base-band signals by the 1st optical interface unit (130), into optical signals by the UDCU (120) and transmitted to the BTS.

The optical signals received by the BTS are converted into base-band signals by the 1st optical interface unit (130), up-converted into RF signals by the UDCU (120) and amplified by the LPAU (110). The amplified signals are filtered by the TxFU (100) and transmitted to the MS via the antenna..

Industrial Applicability

This invention provides the following advantages. By the concept of pool applied to a voice codec incorporated in the BSC, the capacity of the BTS channels (of this invention) is sufficient enough to accommodate as many subscribers as possible with a small number of channels. For example, the wireless communication system according to this invention includes P BTSs having N channels and the BSC incorporating the CHU having M channel blocks. Therefore, the system can implement a channel pool having PxNxM channels, which provides a far more capacity than the conventional BTS that provides the channel pool of NxM channels. As a result, the channel load can be drastically reduced.

In addition, even when the BTS channels are out of service,

this invention can minimize the failure impact on the number of subscribers to be accommodated by the BTS. Because the CHU is incorporated in the BSC instead of the BTS, a compact BTS can be implemented without strict requirements for installation sites. Further, the CHU need not be installed per BTS and BTS installation costs can be significantly saved.

What has been described is merely illustrative of the application to the principles of this invention. Other arrangements and methods can be implemented by those skilled in the art without departing from the spirit and scope of this invention.

<u>What is caimed is :</u>

1. A wireless communication system for dynamically allocatting channels unsishan of a base transseiver stating BTS unit and a base station contraller (BSC) unit, characteriged in that: the base transceiver station (BTS) unit includes;

an Rx unit for limiting the band of radio frequency (RF) signals transmitted by a mobile station (MS) and received by an Rx antenna, and amplifying the received weak signals in a reverse link, an updown converter for down-converting the RF signals received from the Rx unit into base-band signals in the reverse link and up-converting the base-band signals into the RF signals in a forward link,

the 1st optic interface unit for modulating the base-band signal to optic signals in the reverse link and modulating the optic signals to the base-band signals for transfer to the up/down converter in the forward link, a multi-channel amplifier for receiving and amplifying multi-channel RF signals received from the up/down converter simultaneously in the forward link, and a Tx unit that limits the RF signals received from the multi-channel amplifier within a specific bandwidth and radiating them over the air,

the base station controller (BSC) unit includes;

a 2nd optic interface unit for modulating the optic signals from the BTS unit into the base-band signals in the reverse link and modulating the base-band signls into the optic signals in the

forward link, a high speed switch unit (HSSU), a combiner unit for distributing the base-band signals transmitted by the 2nd interface unit to the HSSU in the reverse link and combining the signals received from the HSSU digitally in the forward link, and a channel card unit that digitizes the signals received from the HSSU and returning the digitized signals to the HSSU.

2. The wireless communication system for dynamically allocating cannels of claim 1, wherein the combiner unit includes a combiner and a processor & HSSU intervace unit.

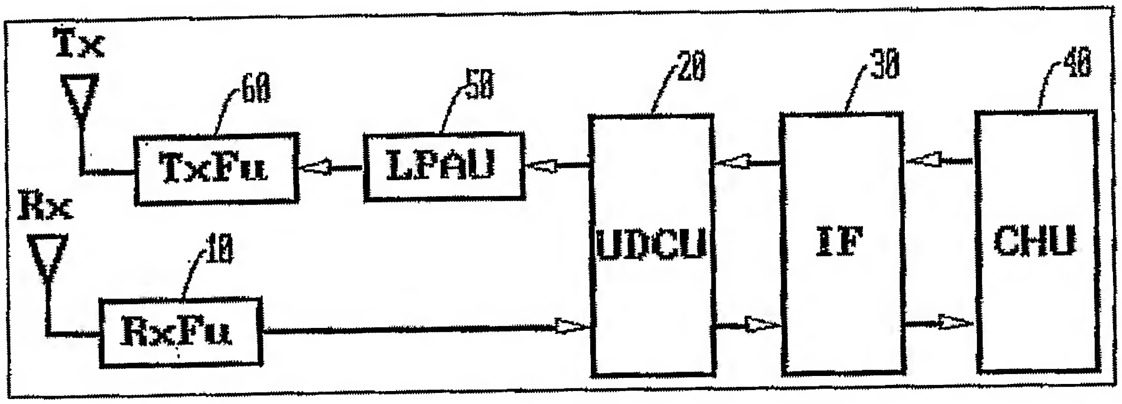
3. A channel card unit used in the wireless communication system described in the claim 1, characteriged in that channel card unit compises of;

a local switch for interfacing with a high speed switch unit (HSSU) and routing signals received from the HSSU to relevant channels in parallel at high speeds,

a base station controller (BSC) modem for interfacing signals serially, and

at least one channel block for including a serial-to-parallel unit that converts serial signals into parallel signals and vice versa in order to interface with the local switch and the modem and that is subject to the interface of the modem.

Fig.1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10
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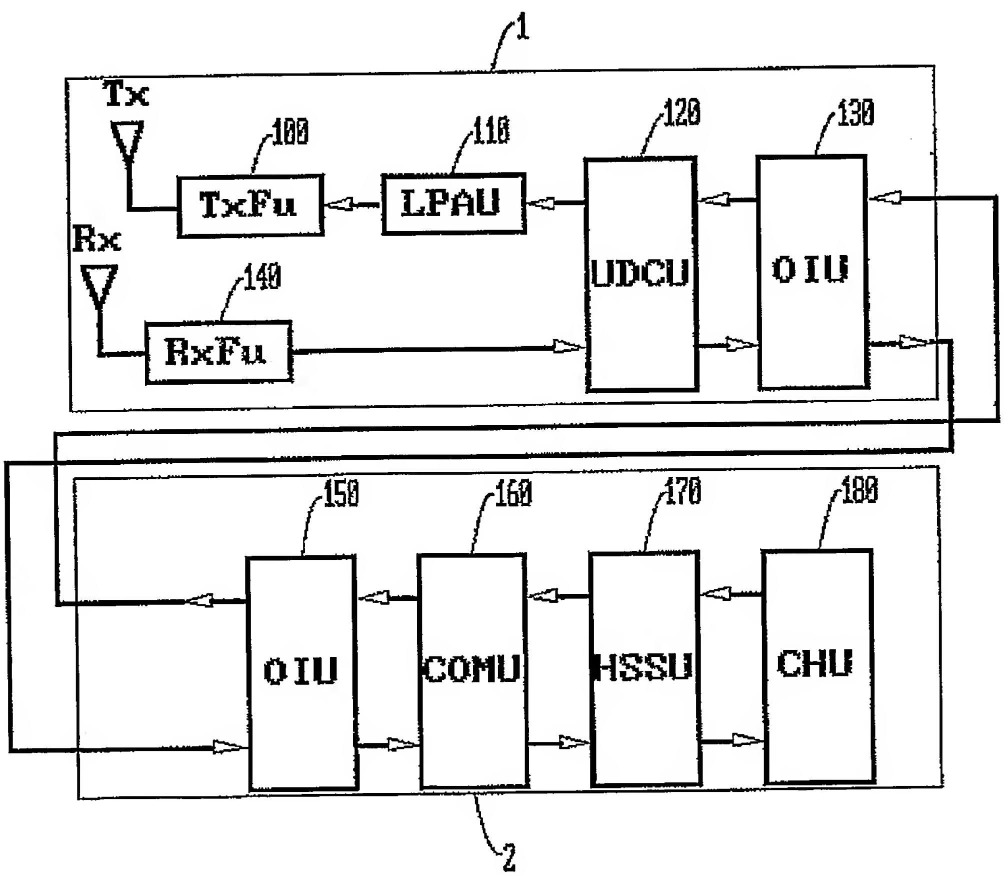
IF
CHU
RxFu

Fig. 2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UDCU
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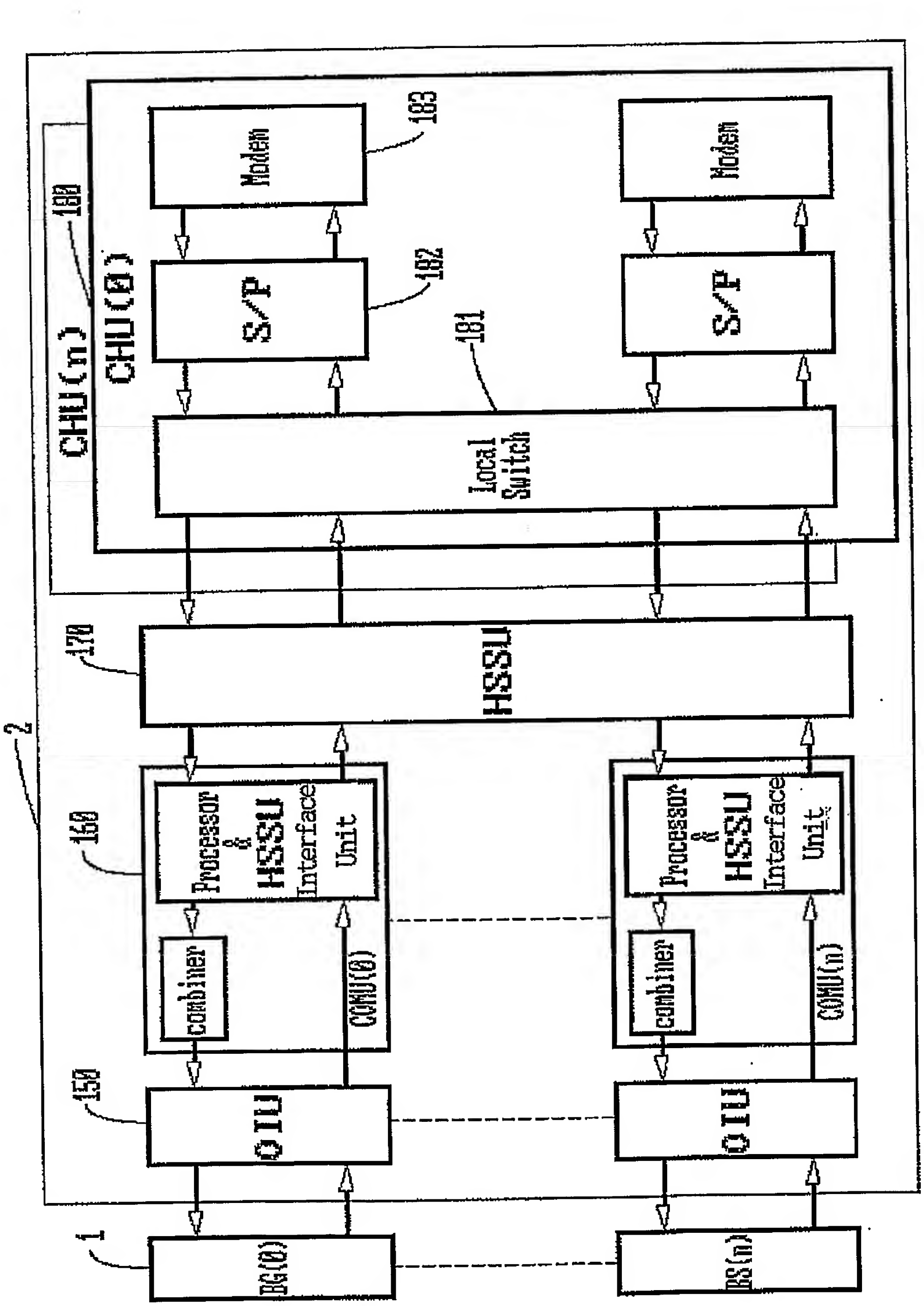
RxFu
150
160
170
180
OIU
COMU
HSSU
CHU
2

Fig. 3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183
Modem
180
CHU(0)
CHU(n)
S/P
182
S/P
181
Local Switch
170
HSSU
2
160
Processor & HSSU Interface Unit
Processor & HSSU Interface Unit
combiner
combiner
COMU(0)
COMU(n)
150
OIU
OIU
1
BS(0)
BS(n)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR01/01602

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04B 7/155

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimun documentation searched (classification system followed by classification symbols)

Documentation searched other than minimun documentation to the extent that such documents are included in the fileds searched

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search trerms used)
KIPO Searching Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,424,864(1995. 6. 13), Abst., Fig1	1-3
Y	PJA4-127622(1992.4.28 Published), Abst., Fig1, Fig2	1-3

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/KR	Authorized officer
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